

## 5.7 Rational Exponents

- write expressions with rational exponents in radical form and vice versa
- simplify

For all

$$b \in \mathbb{R}$$

$$n \in \mathbb{Z}$$

$$\sqrt[n]{b} = b^{\frac{1}{n}}$$

Radical Form      Exponential Form

Exponential Form

Radical Form

$$8^{\frac{1}{3}}$$

$$\sqrt[3]{8} = 2$$

$$64^{\frac{1}{2}}$$

$$\sqrt{64} = 8$$

$$16^{\frac{1}{4}}$$

$$\sqrt[4]{16} = 2$$

$$x^{\frac{1}{5}}$$

$$\sqrt[5]{x^1}$$

$$x^{\frac{3}{4}}$$

$$\sqrt[4]{x^3}$$

$$b^{\frac{m}{n}} = \sqrt[n]{b^m}$$

For all  $b \in \mathbb{R}$  ( $b \neq 0$ ) and  $m, n \in \mathbb{Z}$  ( $n > 1$ )

Simplified

- no negative exponents
- no fractional exponents in denominator
- not a complex fraction
- index is as low as it can be

Simplify.

$$\sqrt[4]{36x^2} = 36^{\frac{1}{4}} \cdot x^{\frac{1}{2}}$$

$$\stackrel{3^2 2^2}{(36x^2)^{\frac{1}{4}}} = (6^2 x^2)^{\frac{1}{4}} = 6^{\frac{1}{2}} x^{\frac{1}{2}} = \sqrt{6x}$$

$$\stackrel{6^{\frac{1}{2}} x^{\frac{1}{2}}}{\sqrt{6} \sqrt{x}}$$

Simplify.

$$\sqrt[8]{16}$$

$$\sqrt[8]{2^4} = 2^{\frac{1}{2}} = \sqrt{2}$$

$$\begin{matrix} 2^{\frac{4}{8}} \end{matrix}$$

Simplify.

$$\sqrt[15]{32}$$

$$\sqrt[15]{2^5} = 2^{\frac{1}{3}}$$

$$\sqrt[3]{2}$$

$$\sqrt{x^2} \cdot \sqrt{x} \quad \star$$

$$x^{\frac{2}{3}} \cdot x^{\frac{1}{2}}$$

$$x^{\left(\frac{2}{3} + \frac{1}{2}\right)}$$

$$x^{\frac{4+3}{6}} = x^{\frac{7}{6}} = \sqrt[6]{x^7} = x^{\frac{7}{6}}$$

$$\sqrt[12]{9x^6}$$

$$\sqrt[12]{3^2 x^6}$$

$$(3^2 x^6)^{\frac{1}{12}}$$

$$3^{\frac{2}{12}} x^{\frac{6}{12}}$$

$$3^{\frac{1}{6}} x^{\frac{1}{2}}$$

$$3^{\frac{1}{6}} x^{\frac{3}{6}} = \sqrt[6]{3x^3}$$

$$\frac{\sqrt[8]{16}}{\sqrt[6]{2}} = \frac{\sqrt[8]{2^4}}{\sqrt[6]{2}} = \frac{2^{\frac{1}{2}}}{2^{\frac{1}{6}}}$$

$$2^{\frac{3}{6} - \frac{1}{6}} = 2^{\frac{2}{6}} = \sqrt[3]{2}$$

$$9^{-\frac{1}{2}} = \frac{1}{3}$$

$$\frac{1}{9^{\frac{1}{2}}} = \frac{1}{\sqrt{9}} = \frac{1}{3}$$

$$\frac{3}{y^{\frac{1}{2}}} \cdot \frac{y^{\frac{1}{2}}}{y^{\frac{1}{2}}} = \frac{3\cancel{y^{\frac{1}{2}}}}{y} = \frac{3\sqrt{y}}{y}$$

$$\frac{3}{\sqrt{y}} \cdot \frac{\sqrt{y}}{\sqrt{y}} = \frac{3\sqrt{y}}{y}$$

HW  
p261  
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